Analysis of Literacy Ability and Mathematical Problem-Solving Ability reviewed from Student Self-Efficacy

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Abstract

The low levels of mathematical literacy and problem-solving skills among Indonesian students, as reflected in the 2022 PISA results, underscore the need for an in-depth study of the factors influencing these two skills, one of which is self-efficacy. This study aims to describe the characteristics of students' mathematical literacy and mathematical problem-solving skills in relation to their level of self-efficacy. The study employed a qualitative method with a descriptive approach. The research subjects consisted of 26 eighth-grade students from Class VIII G at state islamic junior high school (MTs) in Cirebon, West Java, selected through purposive sampling; subsequently, three students were chosen based on high, moderate, and low self-efficacy categories. Data collection was conducted using a mathematical literacy test instrument, a mathematical problem-solving test instrument, and a self-efficacy questionnaire. Data analysis utilized the Miles and Huberman model, which includes data reduction, data presentation, and drawing conclusions, and its validity was tested through triangulation of methods and sources. The results of the study indicate that students with high self-efficacy possess excellent mathematical literacy and problem-solving skills across nearly all indicators. Students with moderate self-efficacy exhibited an asymmetrical profile, showing weaknesses in the stages of understanding and formulating problems, yet strength in the planning and strategy implementation stages. Students with low self-efficacy demonstrated low ability across all indicators, with the most fundamental weaknesses in the stages of formulating problems and reviewing solution results. There is a consistent trend that the higher a student's self-efficacy, the better their mathematical literacy and problem-solving skills. The problem-formulation and problem-understanding stages consistently emerge as the weakest points across all self-efficacy categories, thus requiring priority in the design of mathematics instruction.

Keywords: Mathematical Literacy, Mathematical Problem-Solving, Self-Efficacy

Introduction

Mathematics is a field of study that plays a strategic role in human life, not only as a discipline in its own right, but also as a tool for logical, critical and systematic thinking when addressing a variety of real-world problems. In the context of global education, students' mathematical ability is measured through two interrelated core competencies: mathematical literacy OECD (2023) and problem-solving skills (National Council of Teachers of Mathematics, 2000; Polya, 1945). Within the PISA framework, mathematical literacy is defined as students' ability to reason mathematically, formulate, use, and interpret mathematics in various real-world contexts (OECD, 2023). Meanwhile, problem-solving ability lies at the heart of mathematical activity, requiring students not only to understand procedures but also to analyse situations, devise strategies, and critically evaluate solutions (Suhengrin et al., 2024).

However, empirical data indicates that Indonesian students' mathematical literacy achievements remain far from satisfactory. In the 2022 PISA results announced on 5 December 2023, Indonesia's mathematics score fell to 366 points 106 points below the global average—ranking 70th out of 81 participating countries (OECD, 2023). According to the OECD, in mathematics, approximately 71% of students do not meet the minimum level of mathematical competence, meaning many Indonesian students still struggle with situations requiring problem-solving skills (OECD, 2023). Indonesian students at level 1a are generally only able to answer mathematical questions involving simple contexts and are not yet capable of thinking creatively to formulate solutions to more complex problems. This situation reflects a significant gap between the demands of 21st-century competencies and the reality of students' mathematical abilities in practice (Dewi et al., 2025; Kemendikbudristek, 2023).

The issue of low mathematical literacy and problem-solving skills cannot be separated from affective factors that also influence students' cognitive performance. The OECD attributes Indonesia's persistently low mathematics performance to structural and pedagogical factors, including limited teacher support for numeracy instruction and socio-economic disparities among students (OECD, 2023). This is corroborated by Indonesian teachers' own accounts: a qualitative study identified inadequate teacher training, curriculum misalignment, resource limitations, and the lingering effects of pandemic-related learning loss as primary contributors to the 2022 decline (Wijaya et al., 2024). Similarly, cognitive activation—the extent to which teaching encourages deep, conceptual reasoning rather than rote procedure—has been identified as the strongest predictor of mathematics achievement among Indonesian students in PISA 2022 (Salma Calista Earthadara, Kismiantini, 2025)

Beyond these structural and instructional factors, one affective factor that has been extensively researched and shown to have a significant influence on mathematics performance is self-efficacy. High mathematical self-efficacy is associated with high mathematical performance, whereas low self-efficacy is associated with poor performance in mathematics (Zakariya, 2022). Bandura (1997) defines self-efficacy as an individual's belief in their ability to organise and carry out the actions necessary to achieve specific outcomes. This belief manifests in three main dimensions: magnitude (belief in coping with varying levels of difficulty), strength (the robustness of self-belief), and generality (belief across various situations). Students with strong mathematical self-efficacy have been shown to be more confident in their ability to succeed, even when facing challenges and setbacks, underscoring the critical role of self-efficacy in building resilience and academic success in mathematics (Igcasama, 2023). In line with this, students' self-efficacy has a positive influence on their mathematical problem-solving ability, with a significant effect of 66.8% (Ahmad & Sari, 2024; Amaliyah et al., 2023). Thus, the higher the self-efficacy, the higher the students' mathematical problem-solving ability (Noor & Amidi, 2024; Wahyuni et al., 2023).

The relationship between self-efficacy and mathematical literacy has also been revealed in several recent studies. (Ananda & Wahyuni, 2022) found that students' mathematical literacy abilities vary depending on their level of self-efficacy. Furthermore, students with moderate self-efficacy are able to apply mathematical literacy skills just like those with high self-efficacy, though they are unable to write down important information in full. Meanwhile, the ability to solve complex mathematical problems has become a key indicator of students' mathematical literacy and innovative capacity, and self-efficacy has been shown to correlate significantly with and predict the ability to solve complex mathematical problems (Abida, 2022; Hasibuan et al., 2025).

In the context of problem-solving skills, Polya (1973) formulated four systematic stages comprising understanding the problem, planning a solution, applying a strategy, and interpreting and reviewing the results. Students' success in navigating these four stages is greatly influenced by the extent of their self-confidence. Wahyuni et al., (2023) In his correlational study, it found a significant relationship between self-efficacy and students' mathematical problem-solving abilities. This relationship is consistent with the findings (Rahmawati & Nopriana, 2024), who also reported a positive correlation between the two variables in high school students. On the other hand, (Du, 2023) found that intrinsic motivation and self-efficacy mediated the relationship between teacher-student relationships and non-routine problem-solving abilities in grade IX students. In addition to correlating with problem-solving skills, self-efficacy has also been shown to be closely related to mathematical literacy. The results of the Pearson correlation test showed a positive and significant relationship between self-efficacy and mathematics literacy of high school students ($r = 0.598$; $p < 0.05$) (Ananda & Wandini, 2022). In other words, the higher the self-efficacy students have, the better their ability to formulate, apply, and interpret mathematics in a real context — the three core processes that form the basis of mathematical literacy according to the PISA framework (OECD, 2023).

Although research on self-efficacy and mathematical ability has been extensive, the majority of these studies have focused on quantitative approaches that measure the general influence of self-efficacy without delving deeply into the characteristics of each ability within each category of self-efficacy. Qualitative studies analysing profiles of mathematical literacy and problem-solving abilities simultaneously based on levels of self-efficacy among MTs students remain very limited. However, a deep understanding of the characteristics of these two abilities within each self-efficacy category is essential as a basis for designing targeted learning interventions based on students' individual needs.

Against this background, this study aims to analyse in depth the characteristics of students' mathematical literacy and mathematical problem-solving abilities in relation to their self-efficacy levels among Year 8 students at state islamic junior high school (MTs) in Cirebon, West Java. It is hoped that the results of this study will provide a theoretical contribution in the form of a more comprehensive understanding of the relationship between self-efficacy, mathematical literacy, and problem-solving, as well as offering practical implications for teachers in designing mathematics lessons that give due consideration to the affective dimension of students.

Method

This study uses a qualitative method with a descriptive approach, which aims to describe in depth the characteristics of students' mathematical literacy ability and problem-solving ability reviewed from the level of *Self Efficacy*. The research subjects comprised 26 grade VIII students from a state islamic junior high school (MTs) in Cirebon, West Java. The determination of research subjects is carried out by *purposive sampling technique,* which is deliberately selecting subjects based on certain criteria that are relevant to the research objectives. The criteria for selecting subjects are based on the level *of Self Efficacy*, which is classified into three categories, namely high, medium, and low Self Efficacy.

The research instruments include mathematical literacy ability test instruments, mathematical problem-solving test instruments and *student self-efficacy* questionnaires. The questionnaire is used as an initial instrument to map the level of *self-efficacy* of students, while the test instrument is used to measure students' literacy and problem-solving skills. The Mathematical Literacy Ability Test Instrument is based on the Izzati & Al Farizi indicator (2025); the Mathematical Problem-Solving Ability Test Instrument is based on George Polya's indicator in Izzati & Al Farizi (2025); while the Self Efficacy questionnaire refers to the Albert Bandura indicator.

The following are the test results of the three instruments, including: The problem-solving ability instrument used in this study consists of 5 questions that have been tested for validity, differentiation, difficulty, and reliability. The results of the validity test showed that all question items were declared valid, with scores ranging from 0.571 to 0.888, while the difference between the five questions varied from the category of "adequate" to "very good", with the highest score in question number 4 (0.758) and lowest in question number 3 (0.388). Judging from the level of difficulty, questions 1 and 2 are classified as "easy" (0.904 and 0.831), while questions 3, 4, and 5 are classified as "moderate" (0.627; 0.624; and 0.618 respectively), so that the five question items are declared eligible and suitable for use. In addition, the results of the reliability test using Cronbach's Alpha formula produced a coefficient of 0.786 which was in the high category, so that the problem-solving ability instrument in this study was declared valid, proportional in terms of differentiation and level of difficulty, and reliable for use in collecting research data.

The mathematical literacy instrument tested in this study consisted of 8 questions. The results of the validity test showed that 7 out of 8 questions were declared valid with scores ranging from 0.647 to 0.791, while question number 1 was declared invalid (0.406) so it was not used in the research. Judging from the differences, the seven valid questions are classified as "good" with a score between 0.539 and 0.690, while the level of difficulty varies from the category "easy" (question number 4), "medium" (questions number 2, 3, 5, and 6), to "difficult" (questions number 7 and 8). Based on these results, the seven valid question items were declared suitable for use as research instruments, while question number 1 was dropped. Furthermore, the results of the reliability test using Cronbach's Alpha formula produced a coefficient of 0.771 which is in the high category, so that the mathematical literacy instruments in this study were declared reliable to be used in the collection of research data.

The self efficacy instrument tested in this study consisted of 35 statements. The results of the validity test showed that 23 of the 35 statements were declared valid with scores ranging from 0.418 to 0.953, while the other 12 items (numbers 6, 8, 10, 11, 14, 15, 16, 18, 21, 23, 31, and 34) were declared invalid, marked with low scores or even negative values, so they were not used in the study. Based on these results, the 23 valid statements were declared suitable for use as an instrument for measuring student self-efficacy. Furthermore, the results of the reliability test using Cronbach's Alpha formula produced a coefficient of 0.746 which is in the high category, so that the self efficacy questionnaire instrument in this study was declared reliable to be used in the collection of research data.

Data collection began with the distribution of mathematical literacy ability test instruments, mathematical problem-solving ability test instruments and *Self Efficacy* questionnaires to all grade VIII G students as initial data sources. The data from the *Self Efficacy* questionnaire was then processed to group students into three categories, namely *high, medium, and low self-efficacy*. The grouping is carried out based on the calculation of the mean and standard deviation of the questionnaire score. Based on the results of the grouping, 3 students were selected as research subjects, each consisting of 1 student in the high *self-efficacy* category , 1 student in the medium self-efficacy category, and 1 student *in the low self-efficacy* category , to be analyzed in depth. Data analysis was carried out using the Miles and Huberman model (Miles & Huberman, 1994), covering data reduction, data presentation, and drawing conclusions. The validity of the data is tested through triangulation of methods and sources to increase the credibility of research findings (Sugiyono, 2019).

Results and Discussion

The results of this study are presented based on the grouping of subjects according to the level of Self Efficacy, namely high, medium, and low categories. Based on the results of filling out the Self Efficacy questionnaire by 26 students in grade VIII G, 5 students with the low Self Efficacy category , 18 students with the medium Self Efficacy category , and 3 students with the high Self Efficacy category , as presented in the table 1

Table 1. Self Efficacy level profile in class VIII G

No.	Self-Efficacy Category	Number of Students
1.	High	3
2.	Moderate	18
3.	Low	5
	Total	26

Based on this grouping, 3 students were selected as research subjects for further analysis. The selected research subject is S16 as a subject with a high *Self Efficacy* category . S1 as a subject with a moderate *Self Efficacy* category, and S5 as a subject with *a low* Self Efficacy category.

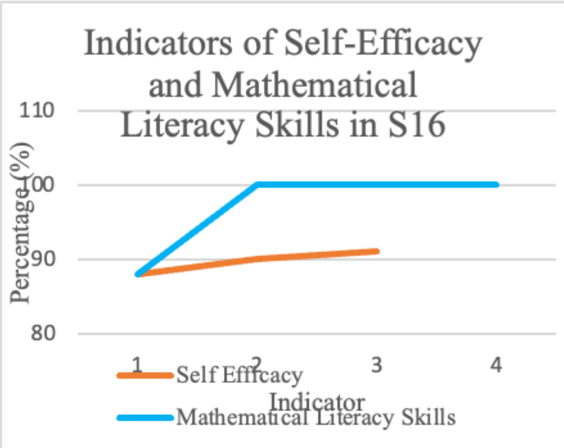

Figure 1. High Self Efficacy and Mathematics Literacy Ability Graph in S16 Subjects

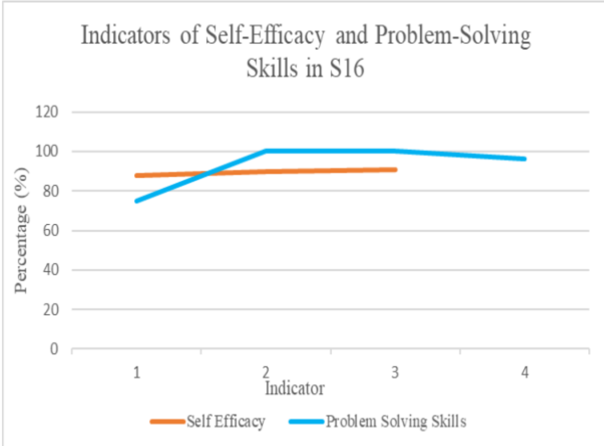

Figure 2. Graph of High Self Efficacy and Problem-Solving Ability in S16 Subjects

Based on the results of the analysis of S16 subjects, a complex and dynamic relationship pattern was found between mathematical literacy skills, problem-solving skills, and self-efficacy in all three dimensions (Magnitude, Strength, and Generality). In the realm of mathematical literacy, S16 subjects showed very strong ability, starting from a percentage of 88% on the Formulate indicator which is in line with the self-efficacy of Magnitude (88%), then jumped to a perfect number of 100% on the Employ, Interpret, and Evaluate indicators, while self-efficacy only increased moderately from 90% (Strength) to 91% (Generality), thus reflecting the phenomenon of underestimation of competence where the subject's actual ability consistently exceeds self-confidence Pajares & Miller (1994). A similar condition was also found in the realm of problem solving, but with a different initial pattern: in the indicator of understanding the problem, the self-efficacy of the Magnitude (88%) actually exceeded the actual ability of the subject (75%), which indicated an overestimation of competence as described by Kruger & Dunning (1999), before a significant crossover occurred in the second indicator where the ability to plan problem-solving jumped dramatically to 100% exceeded the self-efficacy Strength (90%), and remained stable at 100% at the stage of implementing the strategy, with the self-efficacy Generality still lagging behind at 91%, indicating that the S16 subjects had not fully internalized the belief in the flexibility of their abilities across the context of Zimmerman & Campillo (2003), while in the last indicator, namely interpreting and re-examining the results of the completion, there was a slight decrease to 96% which confirmed the findings Garofalo & Lester (1985) that the evaluation and verification stage is the most vulnerable aspect even in high-ability students, while in mathematics literacy the evaluation ability of S16 subjects remains perfectly at 100%, reflecting a thorough mastery of the highest mathematical framework as defined by (OECD, 2023).

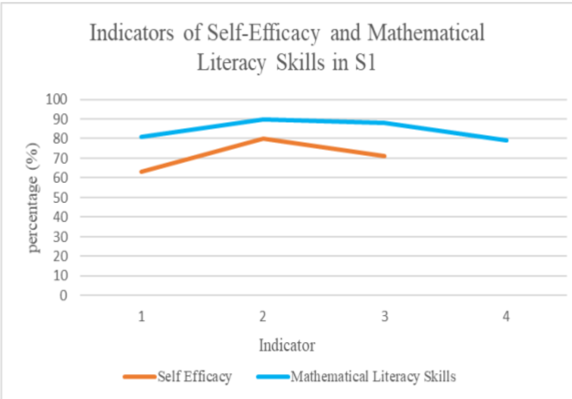

Figure 3. Graph of Medium Self Efficacy and Mathematical Literacy Ability in S1 Subjects

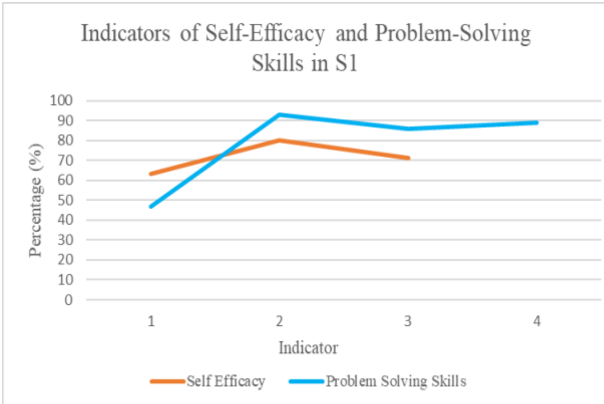

Figure 4. Graph of Medium Self Efficacy and Problem-Solving Ability in S1 Subjects

Based on the results of the analysis of S1 subjects, a dynamic and non-linear relationship pattern was found between mathematical literacy ability, problem-solving ability, and self-efficacy in all three dimensions (Magnitude, Strength, and Generality). In the realm of mathematical literacy, the ability of S1 subjects is consistently above self-efficacy at all measurement points, starting from the Formulate indicator of 81% which far exceeds the self-efficacy of Magnitude (64%), then both reach the peak in the indicators of Employ (90%) and Strength (80%) but with a gap of 10% which reflects the phenomenon of lagging self-efficacy as explained by Zimmerman (2000), then experienced a simultaneous decline in the indicators of Interpret (88%) and Generality (71%) which marked the beginning of the development of the subject's self-awareness of the complexity of the context, until finally literacy ability reached its lowest point on the Evaluate indicator (79%) which confirmed the findings of Garofalo & Lester (1985) that the evaluation stage is the weakest stage due to the immaturity of metacognitive abilities Desoete et al., (2001). In the realm of problem-solving, the pattern found was much more dramatic: subjects in S1 showed a very striking overestimation of competence in the indicator of understanding the problem, where the self-efficacy of the magnitude (64%)

exceeded the actual ability of only 47%, a condition that according to Kruger & Dunning (1999) is common in individuals who do not have adequate metacognitive capacity, and which according to Polya (1973) potentially distorting the entire subsequent settlement process; The most striking shift occurred in the second indicator where the ability to plan solutions jumped dramatically to 92% beyond the self-efficacy of Strength (80%), revealing an asymmetric cognitive profile as identified by Özsoy & Ataman (2009) in which strategic ability developed much more rapidly than conceptual ability; the underestimation pattern then continued in the third indicator where both fell simultaneously to 85% and 71%, respectively. with a decrease in execution ability which is interpreted as the impact of the weak initial understanding of Schoenfeld (1992) and the low self-efficacy of Generality which reflects the limitations of the cross-context of success experience Pajares (1996), while in the fourth indicator there is an interesting recovery to 89% in the ability to re-examine the results of completion, which is interpreted as compensatory checking behavior, namely the subject's tendency to over-check the results. reflective and cautious as compensation for the low self-confidence in the previous stages Schunk & Pajares (2009), so that overall the S1 subject profile describes students with moderate-high mathematical abilities accompanied by self-confidence that has not been optimally calibrated to their actual abilities.

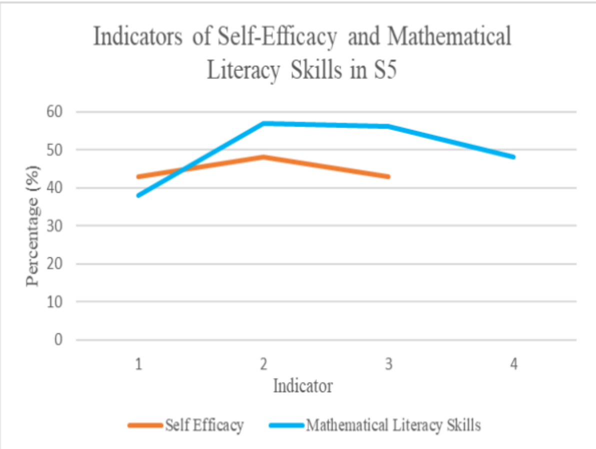

Figure 5. Low Self Efficacy Graph and Mathematical Literacy Ability in S5 Subjects

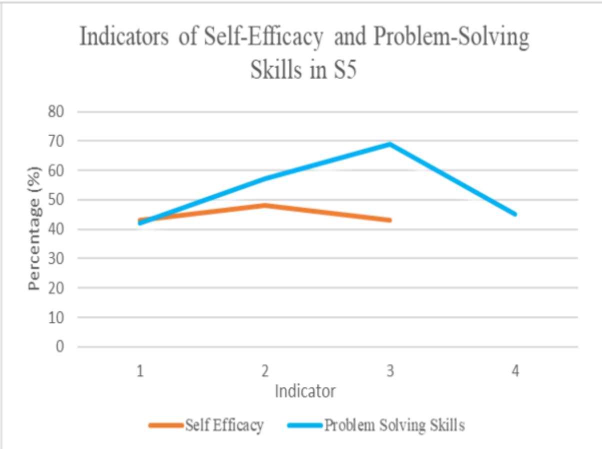

Figure 6. Low Self Efficacy and Problem-Solving Ability Graph in S5 Subjects

Based on the results of the analysis of S5 subjects, a typical pattern of relationship was found between mathematical literacy ability, problem-solving ability, and self-efficacy, where the overall percentage of both variables was in the low range (38%–69%), reflecting the profile of students with mathematical abilities and self-confidence that were both not adequately developed. In the realm of mathematical literacy, S5 subjects showed a calibration pattern at a low level that differed from the underestimation and overestimation patterns consistently: in the Formulate indicator, the actual ability (38%) was slightly below the self-efficacy of Magnitude (43%), indicating mild overestimation at the initial stage which is also a serious signal considering that formulation ability is the first gate of all mathematical activities and fundamental obstacles that have a cumulative impact on the process literacy subsequently (Niss & Højgaard, 2011; OECD, 2023), on the Employ indicator, both increased simultaneously to 57% and 48% which confirms the positive correspondence between self-confidence and actual ability Bandura (1997), however, the peak of ability that is only 57% remains far from the category of sufficient according to the PISA literacy standard; on the Interpret indicator, actual ability is relatively stable at 56% while the generality's self-efficacy drops more sharply to 43% so that the gap widens to 13%, hinting that affective and motivational factors are beginning to dominate the subject's self-perception as there is a lack of accumulation of success experiences across the context of Zimmerman (2000) and in the Evaluate indicator, there was a significant decrease to 48% which explicitly confirmed the weak metacognitive ability of S5 subjects as stated by Desoete et al., (2001) that low metacognition is strongly correlated with low mathematical evaluation scores (Garofalo & Lester, 1985). In the realm of problem-solving, S5 subjects showed a much greater amplitude of change (43%–69%) compared to relatively stable self-efficacy in a narrow range (43%–48%), suggesting that the subjects' problem-solving performance was more influenced by the complexity of cognitive stages than by the self-confidence factor of Pajares & Miller (1994) in detail, the ability to understand the problem was at 43% in line with the self-efficacy of Magnitude (43%), then increased at the stage of planning the solution (58%) with the self-efficacy Strength which also rose to 48%, then reached its peak at the stage of implementing strategies (69%) which indicated the ability to execute procedures was relatively stronger than other aspects, while the self-efficacy of Generality decreased slightly to 43%; however, problem-solving ability experienced the most significant decline at the stage of re-examining the completion results to 45%, confirming the findings of Phonapichat et al., (2014) and Polya (1973) that the looking back stage is the stage that is most often ignored by students, so that overall the profile of the S5 subject describes students who have procedural potential that has not been balanced with adequate evaluative and metacognitive skills, with a small increase in the dimension of Strength self-efficacy which according to Hoffman (2010) can be the most strategic point of intervention to be developed through structured learning.

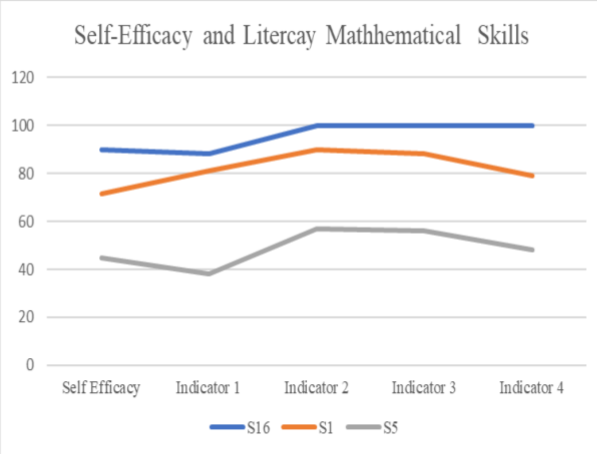

Figure 7. Graph of Self Efficacy and Mathematical Literacy Ability in S16, S1 and S5 Subjects

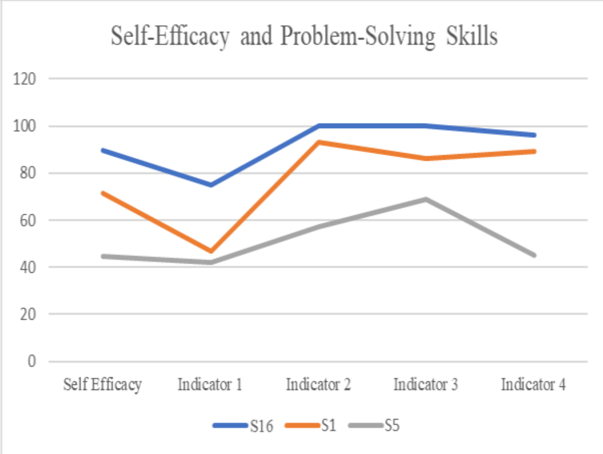

Figure 8. Graph of Self Efficacy and Problem-Solving Ability in Subjects S16, S1 and S5

Based on the results of a comparative analysis of the three research subjects, namely S16 (high self-efficacy), S1 (medium self-efficacy), and S5 (low self-efficacy), it was found that a generally positive relationship pattern between the level of self-efficacy and mathematical literacy and problem-solving skills was found, but with rich nuances and variations in each indicator so as to modify the simple view of the linearity of the relationship. In the realm of mathematical literacy, S16 presents the most consistent and dominant profile with perfect achievement in the last three indicators confirming the proposition of Pajares (1996) and Bandura (1997) that high self-efficacy encourages cognitive persistence and the use of more effective strategies, although a slight decrease in the Formulate indicator confirms Stacey's (2011) view that the process of formulating problems from a real context is the most challenging stage in mathematical literacy even for highly capable students; S1 shows a progressive pattern that peaks in the Employ indicator but decreases in the Evaluate indicator, in line with the findings of Maulana et al., (2019) that students with self-efficacy are able to carry out mathematical procedures well but experience obstacles at the evaluative stage that require high metacognition as affirmed by the OECD (2023) and Zimmerman (2000) while S5 displays the lowest profile with fluctuations that reflect the dominance of procedural ability over contextualization ability, a condition that Wijaya et al., (2014) describe as the impact of learning that is too oriented to procedural drills, as well as a decrease in the Evaluate indicator confirmed by Abidin et al., (2021) as a consequence of low self-confidence that inhibits reflective initiatives. In the realm of problem-solving, the comparison of the three subjects reveals a more dynamic and non-linear pattern: S16 shows high stability with a sharp recovery after the initial resistance in the indicator understanding the problem, confirming the findings of Bandura (1997) that high self-efficacy encourages greater effort in the face of resistance, although the slight decrease in the recheck indicator still confirms the findings of Phonapichat et al., (2014) that the looking back stage receives less attention proportionately even from high-ability students; S1 showed the most dramatic fluctuations among the three subjects with extreme weaknesses in the indicators of understanding problems described through cognitive load theory Sweller (1988) and confirmed by Özcan & Kültür, (2021) that self-efficacy was not yet able to fully activate the cognitive elaboration strategy, but was followed by a significant spike in the planning indicators according to Mayer (1992) reflects mastery of problem patterns that go beyond conceptual understanding, with stability in the third and fourth indicators in line with Hembree's (1992) finding that mathematical anxiety is most strongly inhibited in the early phases of problem processing; while S5 shows a gradual rise from the first to third indicators confirming Yates' (2002) findings that students with low self-efficacy are still able to demonstrate competence in the algorithmic aspect, but are followed by a drastic decrease in the fourth indicator which is interpreted as a manifestation of cognitive fatigue (Zimmerman & Campillo (2003) as well as modifying the view of Polya (1973)) by adding the affective dimension, especially self-efficacy, as a determining factor for the success of the looking back stage; Thus, comprehensively, these findings confirm the meta-analysis of Multon et al., (1991) on the positive correlation between self-efficacy and mathematical performance, while modifying it with empirical evidence that the strength of these correlations is not uniform but rather varies significantly depending on the type of indicator measured, where the impact of self-efficacy is most strongly felt on indicators that demand high metacognitive and evaluative abilities such as Formulate, Evaluate, and Look Back, and emphasize the need for different and differentiated interventions according to the self-efficacy profile of each student.

Conclusion and Suggestion

This study provides an in-depth description of the characteristics of mathematical literacy and mathematical problem-solving skills among Year 8 students in Class G at state islamic junior high school (MTs) in Cirebon, West Java , as viewed from the perspective of self-efficacy. Students with high self-efficacy (S16) demonstrated excellent mathematical literacy and problem-solving skills across almost all indicators, with very strong abilities in designing a solution plan, applying strategies, interpreting solutions, and evaluating results, although the stages of formulating and understanding problems still required reinforcement. Students with moderate self-efficacy (S1) displayed an asymmetrical profile, being very weak in the stages of understanding and formulating problems, yet demonstrating good ability in the stages of planning, applying strategies, and evaluation, reflecting that their procedural skills developed more rapidly than their representational and conceptual understanding. Students with low self-efficacy (S5) demonstrated mathematical literacy and problem-solving abilities that were both in the low category across all indicators, with the most fundamental weaknesses in the problem-formulation and result-checking stages, reflecting limitations in abstract and metacognitive abilities that hinder their overall academic development. Overall, there is a consistent trend that the higher a student's level of self-efficacy, the better their mathematical literacy and problem-solving skills; the problem-formulation stage in mathematical literacy and the problem-understanding stage in problem-solving consistently emerge as the weakest points across all self-efficacy categories. Consequently, these two stages require top priority in the design of mathematics instruction at the MTs level.

Based on the findings of this study, several recommendations can be formulated, including: For mathematics teachers, it is necessary to design lessons that explicitly train the ability to read and represent mathematical problems from the outset, given that the stages of understanding and formulating problems are the most widespread weaknesses across all categories of self-efficacy. For schools, it is important to provide learning support programmes that take into account the affective dimensions of students, rather than focusing solely on improving cognitive abilities. Diagnostic assessments that measure self-efficacy on a regular basis can serve as a useful mapping tool for designing targeted interventions based on individual student needs. For future researchers, it is recommended to expand the scope of the research subjects so that the findings are more representative and can be generalised to a broader context. Further research integrating qualitative and quantitative methods (mixed methods) is also highly recommended to uncover the causal mechanisms between self-efficacy, mathematical literacy, and problem-solving skills more comprehensively.

References

Abida. (2022). Kemampuan literasi matematis peserta didik dalam menyelesaikan latihan SPLDV ditinjau dari self efficacy. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3). https://doi.org/10.24127/ajpm.v11i3.5774

Abidin, Z., Jupri, A., & Prabawanto, S. (2021). Students' mathematical literacy in solving PISA-like problems based on self-efficacy. *Journal of Physics: Conference Series*, *1764*(1), 012125.

Ahmad, T., & Sari, R. A. (2024). Deskripsi literasi matematika pada ruang lingkup pola bilangan ditinjau dari self efficacy siswa. *Issues in Mathematics Education (IMED)*, *8*(1), 23–39.

Amaliyah, R., Hermawan, A., & Sari, D. P. (2023). *Pengaruh self efficacy terhadap kemampuan pemecahan masalah matematis siswa*. *7*, 137–149.

Ananda, E. R., & Wahyuni, R. R. W. (2022). Analisis kemampuan literasi matematika siswa ditinjau dari self efficacy siswa. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *6*(5), 5113–5126. https://doi.org/10.31004/obsesi.v6i5.2659

Ananda, E. R., & Wandini, R. R. (2022). Analisis Kemampuan Literasi Matematika Siswa Ditinjau dari Self Efficacy Siswa. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *6*(5), 5113–5126. https://doi.org/10.31004/obsesi.v6i5.2659

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman and Company.

Desoete, A., Roeyers, H., & Buysse, A. (2001). Metacognition and mathematical problem solving in grade 3. *Journal of Learning Disabilities*, *34*(5), 435–449. https://doi.org/10.1177/002221940103400505

Dewi, Y. M., Purnomo, E. A., & Sulistyaningsih, D. (2025). Studi Literatur Review: Analisis Kemampuan Matematis Siswa Dalam Menyelesaikan Soal PISA di Tinjau Dari Gaya Kognitif Field Dependent dan Field Independent. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *9*(2), 788–799. https://doi.org/10.31004/cendekia.v9i2.3702

Du, X. (2023). Intrinsic motivation and self-efficacy mediate the relationship between teacher-student relationships and non-routine problem-solving in ninth-grade mathematics. *Frontiers in Education*, *9*. https://doi.org/10.3389/feduc.2024.1450499

Garofalo, J., & Lester, F. K. (1985). Metacognition, cognitive monitoring, and mathematical performance. *Journal for Research in Mathematics Education*, *16*(3), 163–176. https://doi.org/10.2307/748391

Hasibuan, N. A., Suparni, S., & Amir, A. (2025). Analisis Kemampuan Literasi Matematika Ditinjau Dari Self Efficacy Dan Pola Pikir Matematis Siswa: Analysis of Mathematical Literacy Ability in Terms of Self-Efficacy and Mathematical Mindset of Students. *Citizen : Jurnal Ilmiah Multidisiplin Indonesia*, *5*(6), 1804–1811. https://doi.org/10.53866/jimi.v5i6.1116

Hembree, R. (1992). Experiments and relational studies in problem solving: A meta-analysis. *Journal for Research in Mathematics Education*, *23*(3), 242–273.

Hoffman, B. (2010). "I think I can, but I'm afraid to try": The role of self-efficacy beliefs and mathematics anxiety in mathematics problem-solving efficiency. *Learning and Individual Differences*, *20*(3), 276–283. https://doi.org/10.1016/j.lindif.2010.02.001

Igcasama. (2023). Perceptions of self-efficacy and anxiety in mathematics. *Pakistan Journal of Humanities and Social Sciences*, *11*(2). https://doi.org/10.52131/pjhss.2023

Izzati, N., & Al Farizi, R. (2025). *Kemampuan Matematis: Teori dan Contoh Instrumen*. CV. Zenius Publisher.

Kemendikbudristek. (2023). *Ringkasan eksekutif hasil PISA 2022*. Pusat Asesmen dan Pembelajaran, Kemendikbudristek.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*(6), 1121–1134. https://doi.org/10.1037/0022-3514.77.6.1121

Maulana, R., Helms-Lorenz, M., van der Molen, M., & Irnidayanti, Y. (2019). Self-efficacy and mathematical achievement: Role of cognitive engagement and task value. *Jurnal Pendidikan Matematika*, *13*(2), 115–130.

Mayer, R. E. (1992). *Thinking, problem solving, cognition* (2nd ed.). W. H. Freeman and Company.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook* (2nd ed.). Sage Publications.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, *38*(1), 30–38.

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. National Council of Teachers of Mathematics.

Niss, M., & Højgaard, T. (2011). *Competencies and Mathematical Learning: Ideas and inspiration for the development of mathematics teaching and learning in Denmark* (Vol. 485). IMFUFA, Roskilde University. http://milne.ruc.dk/ImfufaTekster/

Noor, A. M. & Amidi. (2024). *Kemampuan pemecahan masalah matematis siswa ditinjau dari self efficacy*. *7*, 137–149. https://proceeding.unnes.ac.id/prisma

OECD. (2023). *PISA 2022 Assessment and Analytical Framework*. OECD Publishing. https://doi.org/10.1787/dfe0bf9c-en

OECD. (2023). *PISA 2022 results: The state of learning and equity in education*. OECD Publishing. https://doi.org/10.1787/53f23881-en

OECD. (2023). *PISA 2022 Results (Volume I and II)—Country Notes: Indonesia*. OECD Publishing. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/indonesia_c2e1ae0e-en.html

Özcan, Z. Ç., & Kültür, Y. Z. (2021). The relationship between sources of mathematics self-efficacy and mathematics test and course achievement in high school seniors. *SAGE Open*, *11*(3), 1–9.

Özsoy, G., & Ataman, A. (2009). The effect of metacognitive strategy training on mathematical problem solving achievement. *International Electronic Journal of Elementary Education*, *1*(2), 67–82.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, *66*(4), 543–578. https://doi.org/10.3102/00346543066004543

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology*, *86*(2), 193–203. https://doi.org/10.1037/0022-0663.86.2.193

Phonapichat, P., Wongwanich, S., & Sujiva, S. (2014). An analysis of elementary school students' difficulties in mathematical problem solving. *Procedia - Social and Behavioral Sciences*, *116*, 3169–3174. https://doi.org/10.1016/j.sbspro.2014.01.728

Polya, G. (1945). *How to Solve It: A New Aspect of Mathematical Method*. Princeton University Press.

Polya, G. (1973). *How to solve it: A new aspect of mathematical method* (2nd ed.). Princeton University Press.

Rahmawati, S. R., & Nopriana, T. (2024). Self Efficacy Siswa: 7 Indikator Keyakinan Diri dan Tantangan dalam Pembelajaran Matematika SMP. *Suska Journal of Mathematics Education*, *10*(2), 101. https://doi.org/10.24014/sjme.v10i2.32726

Salma Calista Earthadara, Kismiantini. (2025). Path Analysis of Teachers' Cognitive Activation and Students' Mathematics Achievement in PISA 2022 Indonesia. *Jurnal Riset Pendidikan Matematika*. https://jurnal.uny.ac.id/index.php/jrpm/article/view/84865

Schoenfeld, A. H. (1992). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics. In D. Grouws (Ed.), *Handbook for Research on Mathematics Teaching and Learning* (pp. 334–370). MacMillan.

Schunk, D. H., & Pajares, F. (2009). Self-efficacy theory. In K. R. Wentzel & A. Wigfield (Eds.), *Handbook of Motivation at School* (pp. 35–53). Routledge/Taylor & Francis Group.

Stacey, K. (2011). The PISA View of Mathematical Literacy in Indonesia. *Journal on Mathematics Education*, *2*(2), 95–126. https://doi.org/10.22342/jme.2.2.746.95-126

Sugiyono. (2019). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D* (3rd ed.). Alfabeta.

Suhengrin, Sukestiyarno, Y. L., & Masduki, L. R. (2024). Analisis kemampuan literasi matematika berbasis HOTS ditinjau dari kemandirian belajar melalui model PBL berbantuan e-modul. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *8*(3), 2279–2293.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285.

Wahyuni, F., Siagian, M. D., & Fatimah, A. E. (2023). Kemampuan pemecahan masalah matematis ditinjau dari self efficacy: Studi korelasional. *Journal of Didactic Mathematics*, *4*(2). https://doi.org/10.34007/jdm.v4i2.1902

Wijaya, A., van den Heuvel-Panhuizen, M., Doorman, M., & Robitzsch, A. (2014). Difficulties in solving context-based PISA mathematics tasks: An analysis of students' errors. *The Mathematics Enthusiast*, *11*(3), 555–584.

Wijaya, T. T., Hidayat, W., Hermita, N., Alim, J. A., & Talib, C. A. (2024). Exploring contributing factors to PISA 2022 mathematics achievement: Insights from Indonesian teachers. *Infinity Journal*, *13*(1), 139–156. https://doi.org/10.22460/infinity.v13i1.p139-156

Yates, S. M. (2002). The influence of optimism and pessimism on student achievement in mathematics. *Mathematics Education Research Journal*, *14*(1), 4–15.

Zakariya, Y. F. (2022). Improving students' mathematics self-efficacy: A systematic review of intervention studies. *Frontiers in Psychology*, *13*, 986622. https://doi.org/10.3389/fpsyg.2022.986622

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*(1), 82–91. https://doi.org/10.1006/ceps.1999.1016

Zimmerman, B. J., & Campillo, M. (2003). Motivating self-regulated problem solvers. In J. E. Davidson & R. J. Sternberg (Eds.), *The Psychology of Problem Solving* (pp. 233–262). Cambridge University Press.